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| Application No. <u>09/885,609</u> | Prepared by <u>NPB</u> | Tracking Number <u>05883815</u> | |
| Examiner-GAU <u>NELMS-288</u> | Date <u>2/26/04</u> | Week Date <u>1/5/04</u> | |
| | No. of queries <u>2</u> | IPW | |

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| a. Serial No. | f. Foreign Priority | k. Print Claim(s) | p. PTO-1449 |
| b. Applicant(s) | g. Disclaimer | l. Print Fig. | q. PTOL-85b |
| c. Continuing Data | h. Microfiche Appendix | m. Searched Column | r. Abstract |
| d. PCT | i. Title | n. PTO-270/328 | s. Sheets/Figs |
| e. Domestic Priority | j. Claims Allowed | o. PTO-892 | t. Other |

| SPECIFICATION | MESSAGE |
|----------------------------|---|
| a. Page Missing | <p>① pto-1449 firms (10 pages): please either initial or line through citations. (copy provided for reference).</p> <p>② there are two(2) claim 28's in the text. please advise/renumber the claims in the index of claims and text, if necessary.</p> <p><i>Thompson</i></p> |
| b. Text Continuity | |
| c. Holes through Data | |
| d. Other Missing Text | |
| e. Illegible Text | |
| f. Duplicate Text | |
| g. Brief Description | |
| h. Sequence Listing | |
| i. Appendix | |
| j. Amendments | |
| k. Other | |
| <p>initials <i>NPB</i></p> | |
| CLAIMS | RESPONSE <u>1449 initialed</u> |
| a. Claim(s) Missing | <p>The claims were corrected by applicant on 2/26/04 see Preliminary Amendment</p> |
| b. Improper Dependency | |
| c. Duplicate Numbers | |
| d. Incorrect Numbering | |
| e. Index Disagrees | |
| f. Punctuation | |
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| k. Other | initials <i>NPB</i> |

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| U.S. Department of Commerce, Patent and Trademark Office (PTO Form 1449 modified) | | Docket No. AMAT/5351/CPI/LB/ PJS | Serial No. 09/885,609 |
| SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT | | Applicant Mak, et al. | Confirmation No.: 5337 |
| (Use several sheets if necessary) | | Filing Date June 20, 2001 | Group 2818 |
| Examiner Renee R. Berry | | | |

U.S. Patent Documents

| *Examiner Initial | | Document Number | Issue Date | Applicant(s) Name | Class | Subclass | Filing Date If Appropriate |
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Foreign Patent Documents

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OTHER ART

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| MB | C1 | PCT International Search Report from International Application No. PCT/US02/19481, Dated 08 January 2003. |
| | C2 | |
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| MB | B4 | WO 99/65064 ✓ | 12-16-1999 | WIPO | H01L | 21/00 | | X |

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Sheet

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Application Number

09/885.609

Filing Date

06/20/2001

First Named Inventor

Mak et al.

Group Art Unit

2812

Examiner Name _____

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Attorney Docket Number

5351/AMI-00-12

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Application Number

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First Named Inventor

Mak et al.

Group Art Unit

2812

Examiner Name

unassigned

Attorney Docket Number

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No.

Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.

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| Application Number | 09/885.609 |
| Filing Date | 06/20/2001 |
| First Named Inventor | Mak et al. |
| Group Art Unit | 2812 |
| Examiner Name | Unassigned |
| Attorney Docket Number | 5351/AMI-00-12 |

U.S. PATENT DOCUMENTS

| Examiner Initials* | Cite: No. | U.S. Patent Document | | Name of Patentee or Applicant of Cited Document | Date of Publication of Cited Document MM-DD-YYYY | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
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| Application Number | 09/885,609 |
| Filing Date | 06/20/2001 |
| First Named Inventor | Alfred W. Mak |
| Group Art Unit | 2812 |
| Examiner Name | Unassigned |
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| Examiner Initials* | Cite No.† | U.S. Patent Document | | Name of Patentee or Applicant of Cited Document | Date of Publication of Cited Document MM-DD-YYYY | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
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| First Named Inventor | Alfred W. Mak |
| Group Art Unit | 2812 |
| Examiner Name | Unassigned |
| Attorney Docket Number | 5351/AMI-00-12 |

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| | | Filing Date | Herewith |
| | | First Named Inventor | Mak, Alfred |
| | | Group Art Unit | Unassigned |
| | | Examiner Name | Unassigned |
| | | Attorney Docket Number | 5351 / AMI-00-12 |
| Sheet | 1 | of | 1 |

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| Examiner Signature | <i>RLB:MM</i> | Date Considered | <i>4-9-00</i> |
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Unique citation designation number. ²See attached Kinds of U.S. Patent Documents. ³Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 18 if possible. ⁶Applicant is to place a check mark here if English language Translation is attached.

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sequentially repeating the exposure to the first and second reactive gases until an adhesion layer having a desired thickness is formed;
exposing the substrate surface to a third reactive gas;
exposing the substrate surface to a fourth reactive gas; and then
sequentially repeating the exposure to the third and fourth reactive gases until a barrier layer having a desired thickness is formed over the adhesion layer.

27. (Original) The method of claim 26, wherein the first reactive gas comprises a refractory metal-containing compound.

→ 28. (Original) The method of claim 27, wherein the refractory metal-containing compound comprises TDMAT, TDEAT, TiCl_4 , or combinations thereof.

* changed to 24

→ [[28]] 29. (Currently Amended) The method of claim 27, wherein the second precursor gas comprises a reducing compound.

[[29]] 30. (Currently Amended) The method of claim [[28]] 29, wherein the reducing compound comprises H_2 , B_2H_6 , SiH_4 , NH_3 , or combinations thereof.

[[30]] 31. (Currently Amended) The method of claim 27, wherein the third precursor gas comprises a refractory metal-containing compound.

[[31]] 32. (Currently Amended) The method of claim [[30]] 31, wherein the refractory metal-containing compound comprises tungsten.

[[32]] 33. (Currently Amended) The method of claim 27, wherein the fourth comprises a reducing compound.

[[33]] 34. (Currently Amended) The method of claim [[32]] 33, wherein the reducing compound comprises SiH_4 , B_2H_6 , NH_3 , or combinations thereof.

[[34]] 35. (Currently Amended) The method of claim 26, further comprising depositing copper at least partially over the barrier layer.

[[35]] 36. (Currently Amended) The method of claim 26, wherein the adhesion layer is deposited within a first processing chamber.

[[36]] 37. (Currently Amended) The method of claim [[35]] 36, wherein the barrier layer is deposited within a second processing chamber.

[[37]] 38. (Currently Amended) The method of claim [[36]] 37, wherein the copper is deposited in a third processing chamber.

[[38]] 39. (Currently Amended) The method of claim [[37]] 38, wherein the first, second and third processing chambers are each disposed about a common mainframe.

[[39]] 40. (Currently Amended) The method of claim [[35]] 36, wherein the adhesion layer and the barrier layer are both deposited in the first chamber.

[[40]] 41. (Currently Amended) A method for depositing a barrier layer on a substrate surface, comprising:

sequentially exposing the substrate surface to a first refractory metal-containing compound and a first reducing compound; and

sequentially exposing the substrate surface to a second refractory metal-containing compound and a second reducing compound to form the barrier layer.

[[41]] 42. (Currently Amended) The method of claim [[40]] 41, wherein the first refractory metal-containing compound comprises TDMAT, TDEAT, TiCl_4 , or combinations thereof.

[[42]] 43. (Currently Amended) The method of claim [[40]] 41, wherein the second refractory metal-containing compound comprises tungsten.

[[43]] 44. (Currently Amended) The method of claim [[40]] 41, wherein the first and second reducing compounds is selected from a group consisting of SiH_4 , B_2H_6 , NH_3 , and combinations thereof.

[[44]] 45. (Currently Amended) The method of claim [[40]] 41, wherein the barrier layer comprises titanium, titanium nitride, tungsten, tungsten nitride, or combinations thereof.

[[45]] 46. (Currently Amended) The method of claim [[40]] 41, wherein the adhesion layer is deposited within a first processing chamber and the barrier layer is deposited within a second processing chamber.

[[46]] 47. (Currently Amended) The method of claim [[40]] 41, further comprising depositing copper at least partially over the barrier layer.

[[47]] 48. (Currently Amended) The method of claim [[46]] 47, wherein the adhesion layer is deposited within a first processing chamber and the barrier layer is deposited within a second processing chamber.

[[48]] 49. (Currently Amended) The method of claim [[47]] 48, wherein the copper is deposited in a third processing chamber and the first, second and third processing chambers are each disposed about a common mainframe.

[[49]] 50. (Currently Amended) The method of claim [[47]] 48, wherein the adhesion layer and the barrier layer are both deposited in the first chamber.

[[50]] 51. (Currently Amended) A method for forming a metal contact on a substrate surface, comprising:

sequentially exposing the substrate surface to a titanium-containing compound and a nitrogen-containing compound to form an adhesion layer comprising titanium nitride;

sequentially exposing the substrate surface to a tungsten-containing compound and a reducing compound to form a barrier layer comprising tungsten; and

depositing copper at least partially over the barrier layer to form the metal contact.

[[51]] 52. (Currently Amended) The method of claim [[50]] 51, wherein the tungsten-containing compound comprises TDMAT, TDEAT, TiCl_4 , or combinations thereof.

[[52]] 53. (Currently Amended) The method of claim [[50]] 51, wherein the reducing compound is selected from a group consisting of SiH_4 , B_2H_6 , NH_3 , and combinations thereof.

[[53]] 54. (Currently Amended) The method of claim [[50]] 51, wherein the adhesion layer is deposited within a first processing chamber and the barrier layer is deposited within a second processing chamber.

[[54]] 55. (Currently Amended) The method of claim [[53]] 54, wherein the copper is deposited in a third processing chamber and the first, second and third processing chambers are each disposed about a common mainframe.